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A BIOLOGICAL EVALUATION OF THE FOBES, MAY VALLEY, AND BONITA SALE AREAS ON THE SAN JACINTO RANGER DISTRICT, SAN BERNARDINO NATIONAL FOREST

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ABSTRACT

In response to a request by the San Jacinto Ranger District, Dave Schultz, entomologist, and Dick Smith, plant pathologist, conducted biological evaluations of the Fobes, May Valley, and Bonita fuelwood sale areas on April 29 to May 1, 1985. Annosus root disease, western dwarf mistletoe, California flatheaded borer, and the red turpentine beetle were involved in pest complexes causing current tree mortality in these sale areas. Current levels of tree mortality will continue and will most likely increase, particularly during dry years, if the stands are not adequately treated. Alternative treatments include: do nothing, removal of dying and heavily diseased trees, removal of dwarf mistletoe infected overstory, thinning of overstocked stands, borax treatment of stumps, and gopher control in regeneration units.

INTRODUCTION

Pine mortality has been a continuing problem for several decades in certain parts of the San Jacinto Ranger District, particularly in the Garner Valley area. The District is planning three fuelwood sales, Fobes, May Valley, and Bonita Sales, and would like to include silvicultural treatments which would decrease future pest-caused mortality in the future. Doug Pumphrey, District Ranger, requested an evaluation of these three sale areas. We made these evaluations on April 29 and 30 in the company of Kathy White and Jim Sauser.

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OBSERVATIONS AND DISCUSSION

The Fobes Sale Area was examined on April 29. This is a rather open stand of 65-year-old Jeffrey pine growing in the bottom of Garner Valley on the eastern edge of its central meadow. This and neighboring stands in the Garner Valley area have been experiencing frequent and above normal pest-caused tree mortality for decades. Several bark beetle suppression projects were conducted in Garner Valley from the early 1950's through the early 1970's, because of the unacceptable tree mortality which occurred off and on during this period. An evaluation of the Quinn Flats Area was made by FPM in 1982. A copy of that evaluation is enclosed.

The overstory is an unevenly stocked, sawtimber-sized Jeffrey pine stand with scattered openings, understocked areas, and a few overstocked areas. Some sparse regeneration of varying age classes exists in places. The ground cover is mainly grasses with pockets of sagebrush. Most of the larger openings in the stand have been created by the cutting of dead and dying pines, often in insect suppression projects. Many of these large openings containing stumps were found to be Fomes annosus root disease centers. Conks of F. annosus were readily found in the older decaying stumps. These root disease centers were distributed generally throughout the whole stand. Tree mortality was occurring on the margins of many of these root disease centers, indicating that they were still active and that future mortality around them can be anticipated. Pockets of western dwarf mistletoe (Arceuthobium campylopodum) infected Jeffrey pines were common throughout the stand. Individual tree infection varied from none to heavy. Some of the more severely infected trees had recently died. In most of these dead trees flatheaded borer (Melanophila californica) and/or red turpentine beetle (Dendroctonus valens) were involved along with the dwarf mistletoe. Understory trees which were within the dwarf mistletoe infested area were usually heavily infected, and have little chance of surviving to maturity. Many of these understory trees were heavily broomed and badly deformed. Uninfected 2 to 5 year-old Jeffrey pines were observed growing under the protective cover of the sagebrush plants. Signs of gopher activity were plentiful throughout most of this stand.

The May Valley and Bonita Sale Areas were examined on April 30. The stand composition and pest problems in these two areas were so similar that they will be discussed together. These were mixed-age and mixed-species stands containing mainly Jeffrey pine, Coulter pine, and black oak. A few scattered incense-cedar and sugar pine were also present. Annosus root disease was present, but not common in each of these stands. Only two active centers were observed in each. Dwarf mistletoe on Jeffrey and Coulter pines was the most common and potentially damaging pest present and, along with cambial feeding insects, was the cause of most of the current tree mortality.

MANAGEMENT ALTERNATIVES

1. Do Nothing. Tree mortality will continue to be chronic, except during and immediately after years of below normal rainfall when it could become a major problem. Dwarf mistletoe will continue to intensify, resulting in scattered

mortality in the overstory and increasing tree deformity and early tree mortality in the understory. Established root disease centers will continue to expand. This will result in increasing annual mortality and additional areas which will remain unstocked for the next 30 to 50 years. Gophers, root disease, and dwarf mistletoe will cause most efforts at regeneration to fail in the long run.

2. Salvage dead and dying trees. Prompt removal of the dead and dying trees will enhance the scenic value along the roads and realize some economic value from the pest-killed trees.

Mortality can be expected to continue at about the same rate and repeated salvage sales will be necessary in the future. The production of green slash from salvage of dying trees, if left untreated, would increase the populations of pine engraver beetles and run the risk of increased pine mortality. Another consideration is that the major method of harvesting trees is through fuelwood sales to local residents. It is very possible that some of these dead and dying trees could contain broods of the engraver beetles and after transport to or near the local residents homes these broods could mature, emerge, and attack and kill the surrounding young pines and the tops of older pines.

3. Integrate pest management considerations into stand management. The integration of pest management considerations into stand management plans and actions should result in lower levels of tree mortality during years of average and above average rainfall and prevent widespread tree mortality during drought years. However, some mortality will continue to occur, especially in and around existing root disease centers, in overstocked stands, and untreated dwarf mistletoe infected stands and trees.

Specific components of an integrated pest management system which appear to be appropriate for the stands examined include the following:

a. Borax stump treatment. Annosus root disease was involved in a substantial portion of the tree mortality observed in the Fobes Sale Area and, with the creation of more stumps during harvesting, could become a more important problem in the May Valley and Bonita Sale Areas. Where present in Southern California, this disease has usually become the most difficult pest problem the forest manager has to contend with. Control options are limited, it remains active and destructive for decades, and the infected trees provide a place for bark and engraver beetles to maintain higher than usual populations. Treatment of all freshly cut conifer stumps with borax is required in and near all recreation sites (FSM R-5 Supp. 2305 and 2331.5).

b. Thinning. Thinning is an effective stand treatment for the prevention of bark beetle-caused mortality in overstocked stands. The beneficial effect of thinning is especially apparent during periods of stress, such as periods (years) of below normal precipitation. Thinning can also be an important method of minimizing the effects of dwarf mistletoe in a stand. This pathogen becomes especially damaging in overstocked stands that stagnate. Thinning of overstocked stands promotes tree growth and the trees grow proportionally faster in height than this parasite moves upward in the trees. Thus the trees

have a lower proportion of their crown infested with the dwarf mistletoe. If thinnings are done early in the life of the stand, the likelihood of the development of annosus infection centers developing is reduced.

The use of eastside pine basal area guidelines should result in the maintenance of good growth that will make the trees resistant to insect attack and killing.

c. Sanitation. Sanitation provides an opportunity to remove trees that are infected by pathogens (and/or insects) that are likely to be attacked by bark beetles. Such a program may reduce overall stand tree mortality and maintain more complete stand stocking by reducing or eliminating the group killing which often occurs around these weak trees when they are attacked by bark and/or engraver beetles. Sanitation is a very useful tool for increasing the vigor and health of stands infected by dwarf mistletoe and for preventing future mortality.

d. Mixed Stands. Many insects and diseases are host specific or attack small groups of closely related trees. Encouraging stands of mixed tree species can reduce the numbers of individuals in the stand which are susceptible to a particular pest and thus reduce the probability that a large portion of the stand will be affected or killed. Non-susceptible trees also act as barriers to the spread of diseases such as root diseases and dwarf mistletoes.

Many of the adverse effects of annosus root disease can be reduced by growing mixed conifer-hardwood stands. Since all hardwoods are immune or highly resistant to annosus root disease, they remain unaffected and also slow or stop the spread of this disease through the stand. Thus the encouragement of oak species in these three sales would reduce the annosus problem in the long run.

Western dwarf mistletoe is specific to ponderosa, Jeffrey, and Coulter pines in these areas. The inclusion of singleleaf pinyon in a mixture in the Fobes Sale Area, where it naturally occurs, would tend to slow or stop the spread of this disease in young stands. Hardwoods, such as oak, would also have the same beneficial effect.

e. Overstory removal. Dwarf mistletoe-infected overstory trees present a special threat to susceptible trees growing nearby. Dwarf mistletoe seeds are forcibly discharged and land in the crowns of the understory trees. Such understory trees often receive numerous infections high in their crowns and thus become very severely infected and distorted. These understory trees have little chance of surviving much beyond the pole-size stage. Removal of infected overstory trees is needed if the replacement stand is to develop properly. Overstory tree removal is best done on an individual tree or group selection basis.

f. Gopher Control. Some form of gopher control will be necessary before many of the openings in the sales can be regenerated. Burrow baiting will reduce the populations, but other vegetation will have to be controlled to prevent the gophers from rapidly moving back into the area.

Integrated pest management refers to the integration of specific stand treatments for reducing and/or preventing pest damage with ongoing silvicultural treatments to meet management objectives. The management alternatives listed may, or may not, be appropriate in any given situation depending on the stand objectives and constraints.

APPENDIX

I. BIOLOGY OF PEST ORGANISMS

Western Dwarf Mistletoe

The dwarf mistletoes are serious forest diseases in much of the western United States, causing extensive growth loss and predisposing conifers to attack by bark beetles and other pathogens. Arceuthobium campylopodum, or western dwarf mistletoe, principally infects ponderosa and Jeffrey pines. Coulter and knobcone pines may be attacked when they grow in association with the principal hosts, while sugar pine and Douglas-fir are not susceptible.

Dwarf mistletoes are flowering plants that require a living host, from which they obtain most of their nutrients and all of their minerals and water. They spread by means of sticky seeds that are forcibly discharged from the plants in the fall, and adhere to whatever they contact. If a seed lands on a host needle or twig, it remains there over winter; the following spring it germinates, and the radicle penetrates the host. The parasite develops a root-like endophytic system in the inner bark and outer sapwood, and produces aerial shoots within 2-4 years after initial infection. Another 2-4 years elapse before seed are produced.

The spread of dwarf mistletoe is limited to the distance the seed travel, which from overstory to understory is usually 20-60 feet; with the aid of wind, seed may be carried as far as 100 feet. A rule of thumb is that dwarf mistletoes can spread a horizontal distance equal to the height of the plants in an infected tree. Because of various limits to spread and the long life cycle, the actual spread rate through an even-aged stand is usually 1-2 feet per year. Vertical spread through a tree crown is about 3-4 inches per year.

The impact of the dwarf mistletoes is influenced significantly by host vigor; slow-growing trees succumb more rapidly than thrifty ones, and dense, stagnated stands are especially vulnerable. A. campylopodum often causes witches' brooms (abnormal proliferations of twigs that appear as clustered masses of foliage); these are usually most pronounced in the lower branches, and eventually lead to the decline of the upper crown.

Annosus Root Disease Of Pine

Fomes annosus is a fungus that attacks a wide range of woody plants, causing a decay of the roots and lower bole and death of sapwood and cambium. All pines in California are susceptible; hardwoods are rarely affected.

The fungus becomes established in freshly cut stumps from air-borne spores produced by fruiting bodies (conks). It then grows into the root system and may spread to adjacent healthy trees via root contacts. Infected pines

are usually killed rather rapidly when F. annosus girdles the root collar. After a suitable period of time, conks are produced under the bark of dead trees or decayed stumps, or in the duff at the root collar.

Local spread of F. annosus outward from a stump results in the formation of disease centers that have dead trees in the middle and dying trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings or groups of non-host plants. The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Pines may seed in or be planted in centers and survive for a few years, but they eventually will be infected and die.

CALIFORNIA FLATHEADED BORER

The California flatheaded borer, Melanophila californica, principally attacks Jeffrey and ponderosa pines, although it may be found in other pines.

It is most severe in stands located on sites where environmental stress is common. Decadent or unhealthy trees are most frequently attacked, along with an occasional top of a thrifty, vigorous tree.

Eggs are laid in bark crevices of the host tree. Newly hatched larvae penetrate directly through the bark to the phloem. Here the larvae may feed from a few months to 4 years without any apparent effect on the host tree. Should host vigor and larval abundance not allow them to succeed, the larvae cut very short galleries before they die. These galleries do not seriously injure the tree and are overgrown by the cambium. Should conditions be, or become, favorable for the larvae and unfavorable for the tree, the larvae develop rapidly and destroy the cambium.

Although this insect can kill trees weakened by dwarf mistletoe and root disease, its primary importance is rendering trees increasingly susceptible to bark beetles.

RED TURPENTINE BEETLE

The red turpentine beetle, Dendroctonus valens, occurs throughout California and can breed in all species of pines. It normally attacks injured, weakened or dying trees and freshly out stumps. The adults are attracted by fresh pine resin. They often attack wounded trees in campgrounds or following logging, trees scorched by wildfire or prescribed burns, lightning-struck trees and root-diseased trees exhibiting resinosis.

Attacks usually occur at the soil line or root crown and are characterized by a large reddish pitch tube at the point of entry. On severely stressed trees or during periods of drought, attacks may occur underground on the main roots up to 15 feet from the bole and also on the bole to a height of 10 feet. If an attack is successful, the adults excavate an irregular gallery in the cambium and the female lays eggs along the sides. The larvae feed in a mass and destroy an area of cambium ranging from 0.1 to 1.0 square feet. Attacks do not always kill trees but may predispose them to attack by other bark beetles. Repeated or extensive attacks by the red turpentine beetle can kill pines.

Attacks occur throughout warm weather and peak at mid-summer. The number of generations varies from two years for a single generation at the coldest portions of its range to two or three per year in the warmest.

Attacks can be minimized or prevented by avoiding soil compaction and injury to standing trees during logging or construction and also by insecticide application to high value trees.

Pocket Gopher

The pocket gopher, Thomomys bottae, is a rodent in the family Geomyidae. They spend most of their life in an extensive tunnel system. The surface openings to their tunnel system are kept well plugged except while burrowing, gathering food a few inches around feed holes, or sometimes following rains. They are highly solitary individuals except when mating or when a mother has young, usually fighting to the death if two are put together.

Pocket gophers do not hibernate and, when burrowing under snow, they deposit the excavated earth in abandoned snow tunnels. The earth cores become visible when the snow thaws.

There is one litter per year born in late spring or early summer. Litter size averages 5 or 6 but may range from one to more than a dozen. Dispersal of the young is often done above ground in late summer or early fall. The population turnover rate is often 70-80% per year due to natural causes.

Pocket gophers feed on a great variety of forbs, grasses, seeds, acorns, tubers, bulbs, roots, bark of trees, and when protected by snow, they gnaw on branches and main stems of conifers several feet above ground.

The most practical method of controlling large numbers of gophers is to place toxic baits underground by hand probing or by use of a mechanical burrow builder. Of the rodenticides that are readily available, strychnine alkaloid is the most effective toxicant. For cleanup work or for small areas where only a few animals are involved, trapping is an effective means of control. Fumigation is generally unsatisfactory because of the extent of the burrow system and the fact that gophers may plug off their burrows when the fumigant is detected.